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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/619,796	07/15/2003	Francis X. Canning	CANNING.001CP2	7886

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EXAMINER
DAY, HERNG DER

ART UNIT	PAPER NUMBER
2128	

DATE MAILED: 07/03/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/619,796	CANNING, FRANCIS X.	
	Examiner	Art Unit	
	Herng-der Day	2128	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _____ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 July 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-14* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *15 July 2003 and 08 December 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *10/14/03,9/12/05,10/14/05.*
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-14 have been examined and rejected.

Priority

2. Applicant's claim for the benefit of a prior-filed application under 35 U.S.C. 119(e) and under 35 U.S.C. 120 is acknowledged. This application is a continuation-in-part of U.S. Patent Application No. 10/354,241, filed January 29, 2003, which is a continuation-in-part of U.S. Patent Application No. 09/676,727, filed September 29, 2000. This application also claims priority benefit of U.S. Provisional Application No. 60/396,133, filed July 15, 2002.

Drawings

3. The drawings are objected to for the following reasons. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the Examiner, the Applicants will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

3-1. FIG. 1A, FIG. 1B, and FIG. 1C should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g).

3-2. As shown in FIG. 11, filed December 8, 2003, it appears that the column indication "1" after the column indication "90" should be "100".

Specification

4. The disclosure is objected to because of the following informalities. Appropriate correction is required.

4-1. It appears that "$g_1(\ell)$, $g_2(\ell)$, and $g_2(\ell)$", as described in lines 7-8 of page 11, should be "$g_1(\ell)$, $g_2(\ell)$, and $g_3(\ell)$".

4-2. It appears that the "$d\ell d\ell$" at the end of the equation as shown in line 4 of page 12, should be "$d\ell d\ell$"".

4-3. It appears that "$I_1 f(\ell)$", as described in line 6 of page 12, should be "$I_1 f_1(\ell)$".

Claim Objections

5. Claim 14 is objected to because of the following informalities: there is no period at the end of claim 14. Appropriate correction is required.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 13 and 14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

7-1. Claim 13 recites the limitation "the operations" in line 1 of the claim. There is insufficient antecedent basis for this limitation in the claim.

7-2. Claim 14 recites the limitation "said factorization" in line 1 of the claim. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 101

8. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

9. Claims 1-14 are rejected under 35 U.S.C. 101 because the inventions as disclosed in claims are directed to non-statutory subject matter.

9-1. Claims 1-14 appear to be directed to the manipulation of abstract ideas of data compression or factorization of an interaction matrix without resulting in a practical application producing a concrete, useful, and tangible result. Hence, the claims are directed to non-statutory subject matter. See In *re Warmerdam,* 33 F.3d 1354, 1360 (Fed. Cir 1994).

9-2. The Examiner acknowledges that even though the claims are presently considered non-statutory they are additionally rejected below over the prior art. The Examiner assumes the Applicant will amend the claims to overcome the 101 rejections and thus make the claims statutory.

Double Patenting

10. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

10-1. Claim 1 is provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of copending Application No. 09/676,727 in view of Canning et al., Rockwell Inst. Sci. Center, "Fast Direct Solution of Standard Moment-Method Matrices", IEEE Antennas and Propagation Magazine, June 1998, pages 15-26.

The conflicting claims are all directed to a method of data compression. However, this instant application has additional limitations "identifying a plurality of sub-matrices in said transformed system of linear equations; and operating on said plurality of sub-matrices to solve said transformed system of linear equations". Canning et al. disclose in section 7 a method solving the MoM matrix using the sparse LU decomposition for an exemplary matrix having three blocks as shown in Figure 5. Using only the sparse representations of L and U to solve J, not only is the factorization process faster, the time to solve for each new excitation is also faster (page 24, right column, paragraph 1).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of copending Application No. 09/676,727 to incorporate the teachings of Canning et al. because using only the sparse representations of L and U to solve J, not only is the factorization process faster, the time to solve for each new excitation is also faster.

10-2. This is a provisional obviousness-type double patenting rejection.

Claim Rejections - 35 USC § 102

11. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

12. Claims 1-4, 6-11, and 13-14 are rejected under 35 U.S.C. 102(b) as being anticipated by Canning et al., Rockwell Inst. Sci. Center, "Fast Direct Solution of Standard Moment-Method Matrices", IEEE Antennas and Propagation Magazine, June 1998, pages 15-26, (IDS 17, filed October 14, 2003), hereinafter referred to as Rockwell.

12-1. Regarding claim 1, Rockwell discloses a method of data compression, comprising:

partitioning a first set of basis functions into groups, each group corresponding to a region, each basis function corresponding to one unknown in a system of linear equations, each of said basis functions corresponding to an original source (basis functions, page 16, left column, paragraph 1);

selecting a plurality of spherical angles (angle, page 15, right column, the last paragraph);

calculating a far-field disturbance produced by each of said basis functions in a first group for each of said spherical angles to produce a matrix of transmitted disturbances (matrix A, page 15, right column, the last paragraph);

reducing a rank of said matrix of transmitted disturbances to yield a second set of basis functions, said second set of basis functions corresponding to composite sources, each of said composite sources comprising a linear combination of one or more of said original basis functions (the SVD of A, page 16, left column, the last paragraph);

partitioning a first set of weighting functions into groups, each group corresponding to one of said regions, each weighting function corresponding to a condition, each of said weighting functions corresponding to an original tester (testing functions, page 16, left column, paragraph 1);

calculating a far-field disturbance received by each of said testers in a first group for each of said spherical angles to produce a matrix of received disturbances (matrix A, page 15, right column, the last paragraph);

reducing a rank of said matrix of received disturbances to yield a second set of weighting functions, said second set of weighting functions corresponding to composite testers, each of said composite testers comprising a linear combination of one or more of said original testers (the SVD of A, page 16, left column, the last paragraph);

transforming said system of linear equations to use said composite sources and said composite testers (the matrix Z is replaced by a sparse representation of Z, page 16, left column, paragraph 4);

identifying a plurality of sub-matrices in said transformed system of linear equations (three blocks in Figure 5, page 21); and

operating on said plurality of sub-matrices to solve said transformed system of linear equations (solving the equation using the sparse LU decomposition, page 24, section 7.6).

12-2. Regarding claim 2, Rockwell discloses a method for factorization of an interaction matrix, comprising:

identifying one or more small-valued elements of an interaction matrix; setting said one or more small-valued elements to zero (a good approximation to A results from approximating the other diagonal elements of D by zero, page 17, left column, paragraph 2);

identifying one or more first sub-blocks in said interaction matrix, said first sub-blocks containing non-zero elements (for example, block 1 in Figure 5, page 21);

identifying one or more second sub-blocks in said interaction matrix, said second sub-blocks containing all zero elements (for example, sub-blocks formed from the first two steps); and

applying a decomposition to said interaction matrix by performing matrix operations on said first sub-blocks (A stabilized Lanczos bi-diagonalization is used to efficiently calculate the low-rank decomposition of these sub-matrices, page 25, right column, paragraph 2).

12-3. Regarding claim 3, Rockwell further discloses wherein said decomposition comprises an LU decomposition (the sparse LU solver, pages 20-21, section 7.1).

12-4. Regarding claim 4, Rockwell further discloses wherein said decomposition comprises matrix inversion (each block of D be inverted, page 20, left column, paragraph 2).

12-5. Regarding claim 6, Rockwell further discloses wherein at least one of said matrix operations is performed using optimized software (using pivoting to stabilize the LU decomposition, page 23, right column, paragraph 4).

12-6. Regarding claim 7, Rockwell further discloses wherein either decompositions of first sub-blocks for a first block row below the main diagonal of said interaction matrix are substantially computed before decompositions on a second block row or a substantial number of decompositions of first sub-blocks for a first block column to the right of the main diagonal of said interaction matrix are substantially computed before decompositions on a second block column (the representation of block one of Z can be changed one column at a time, page 21, right column, the last paragraph).

12-7. Regarding claim 8, Rockwell further discloses wherein said factorization permits direct solution of a system of linear equations and wherein said direct solution comprises the division

by a pivot (using pivoting to stabilize the LU decomposition, page 23, right column, paragraph 4).

12-8. Regarding claim 9, Rockwell further discloses a method, comprising:

generating a block-sparse matrix containing substantially full diagonal blocks and containing more than one substantially sparse block where said more than one substantially sparse block contain non zero elements in substantially similar locations (a sparse representation of Z, page 16, left column, paragraph 4);

identifying one or more sub-blocks in said block-sparse matrix, said sub-blocks containing a plurality of non-zero elements (for example, block 1 in Figure 5, page 21); and

applying a decomposition to said block-sparse matrix using said sub-blocks as a sub-matrix (A stabilized Lanczos bi-diagonalization is used to efficiently calculate the low-rank decomposition of these sub-matrices, page 25, right column, paragraph 2).

12-9. Regarding claim 10, Rockwell further discloses wherein said decomposition comprises an LU decomposition (the sparse LU solver, pages 20-21, section 7.1).

12-10. Regarding claim 11, Rockwell further discloses wherein said decomposition comprises matrix inversion (each block of D be inverted, page 20, left column, paragraph 2).

12-11. Regarding claim 13, Rockwell further discloses wherein at least one of the operations using said sub-blocks as a sub-matrix comprises running optimized decomposition software pivot (using pivoting to stabilize the LU decomposition, page 23, right column, paragraph 4).

12-12. Regarding claim 14, Rockwell further discloses wherein said factorization permits direct solution of a system of linear equations without further division by a pivot (QR decomposition does not require pivoting for stability, page 23, right column, paragraph 3).

Claim Rejections - 35 USC § 103

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

14. Claims 5 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Canning et al., Rockwell Inst. Sci. Center, "Fast Direct Solution of Standard Moment-Method Matrices", IEEE Antennas and Propagation Magazine, June 1998, pages 15-26, (IDS 17, filed October 14, 2003, hereinafter referred to as Rockwell), in view of Applicant's assertion.

14-1. Regarding claim 5, Rockwell discloses a method for factorization of an interaction matrix in claim 2. Rockwell fails to expressly disclose wherein said decomposition comprises an LDM decomposition.

Applicant discloses in the last paragraph of page 39, "Other variations will be evident to those experienced in this field. For example, it is possible to use an LDM decomposition rather than an LU decomposition." In other words, Applicant asserts using an LDM decomposition rather than an LU decomposition is evident to those experienced in this field.

It would have been obvious to one of ordinary skill in the relevant art at the time the invention was made to modify the teachings of Rockwell to incorporate Applicant's assertion to obtain the invention as specified in claim 5 because using an LDM decomposition rather than an LU decomposition is evident to those experienced in this field.

14-2. Regarding claim 12, Rockwell discloses a method in claim 9. Rockwell fails to expressly disclose wherein said decomposition comprises an LDM decomposition.

Applicant discloses in the last paragraph of page 39, "Other variations will be evident to those experienced in this field. For example, it is possible to use an LDM decomposition rather than an LU decomposition." In other words, Applicant asserts using an LDM decomposition rather than an LU decomposition is evident to those experienced in this field.

It would have been obvious to one of ordinary skill in the relevant art at the time the invention was made to modify the teachings of Rockwell to incorporate Applicant's assertion to obtain the invention as specified in claim 12 because using an LDM decomposition rather than an LU decomposition is evident to those experienced in this field.

Conclusion

15. The prior art made of record and not relied upon is considered pertinent to Applicant's disclosure.

Reference to Feldmann et al., U.S. Patent 6,182,270 B1 issued January 30, 2001, and filed November 20, 1997, is cited as disclosing using preconditioners to simplify a non-linear analysis.

Reference to Sercu et al., U.S. Patent 6,353,801 B1 issued March 5, 2002, and filed April 9, 1999, is cited as disclosing dividing the interaction matrix at level 1 into sub-matrices that depend on basis functions at the various levels.

16. Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Herng-der Day whose telephone number is (571) 272-3777. The Examiner can normally be reached on 9:00 - 17:30.

Any inquiry of a general nature or relating to the status of this application should be directed to the TC 2100 Group receptionist: (571) 272-2100.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, Kamini S. Shah can be reached on (571) 272-2279. The fax phone numbers for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Herng-der Day
June 26, 2006 H.D.

Thai Phan
Patent Examiner
Art. 2128